Figure 1-1. Hanford Site Map.

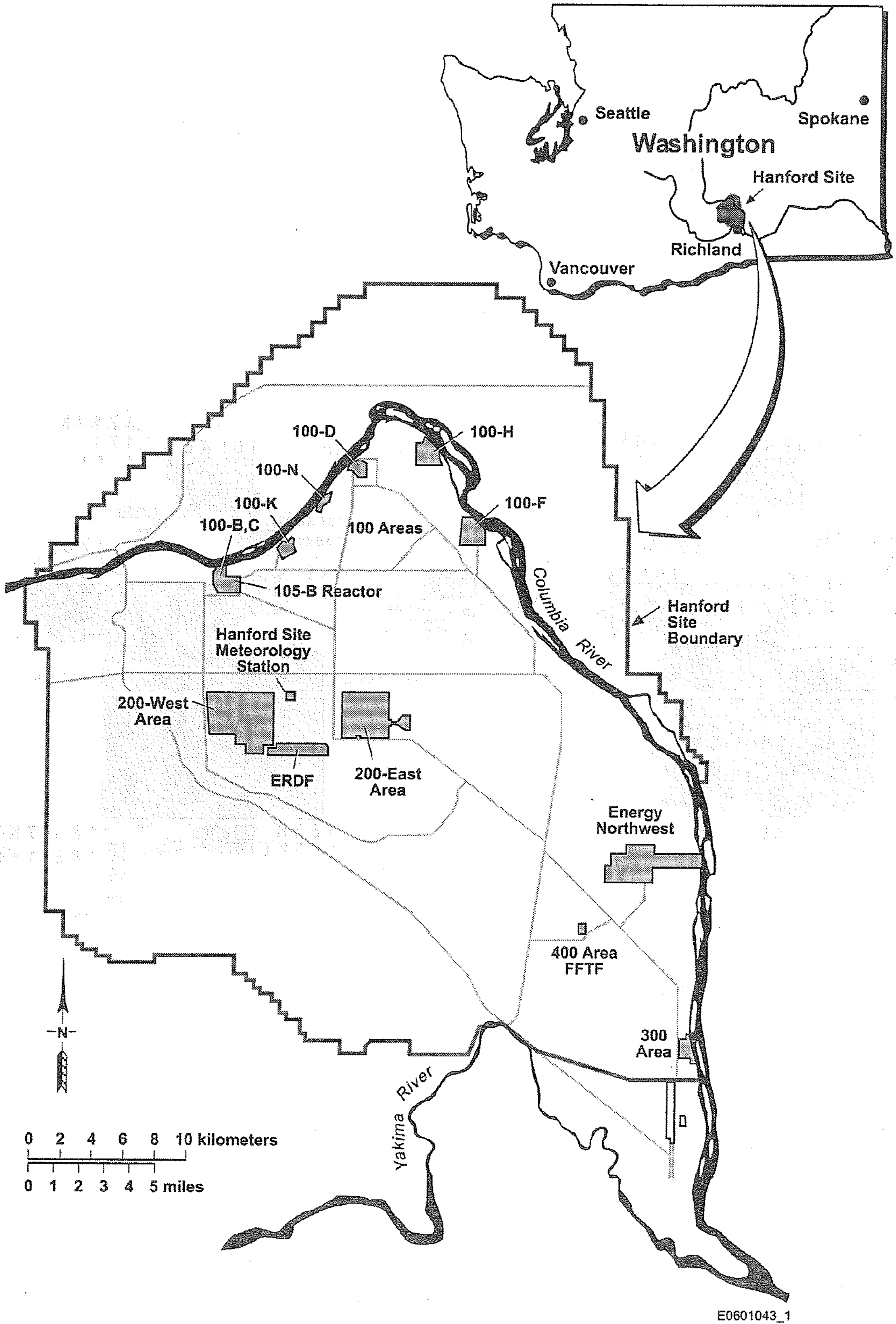
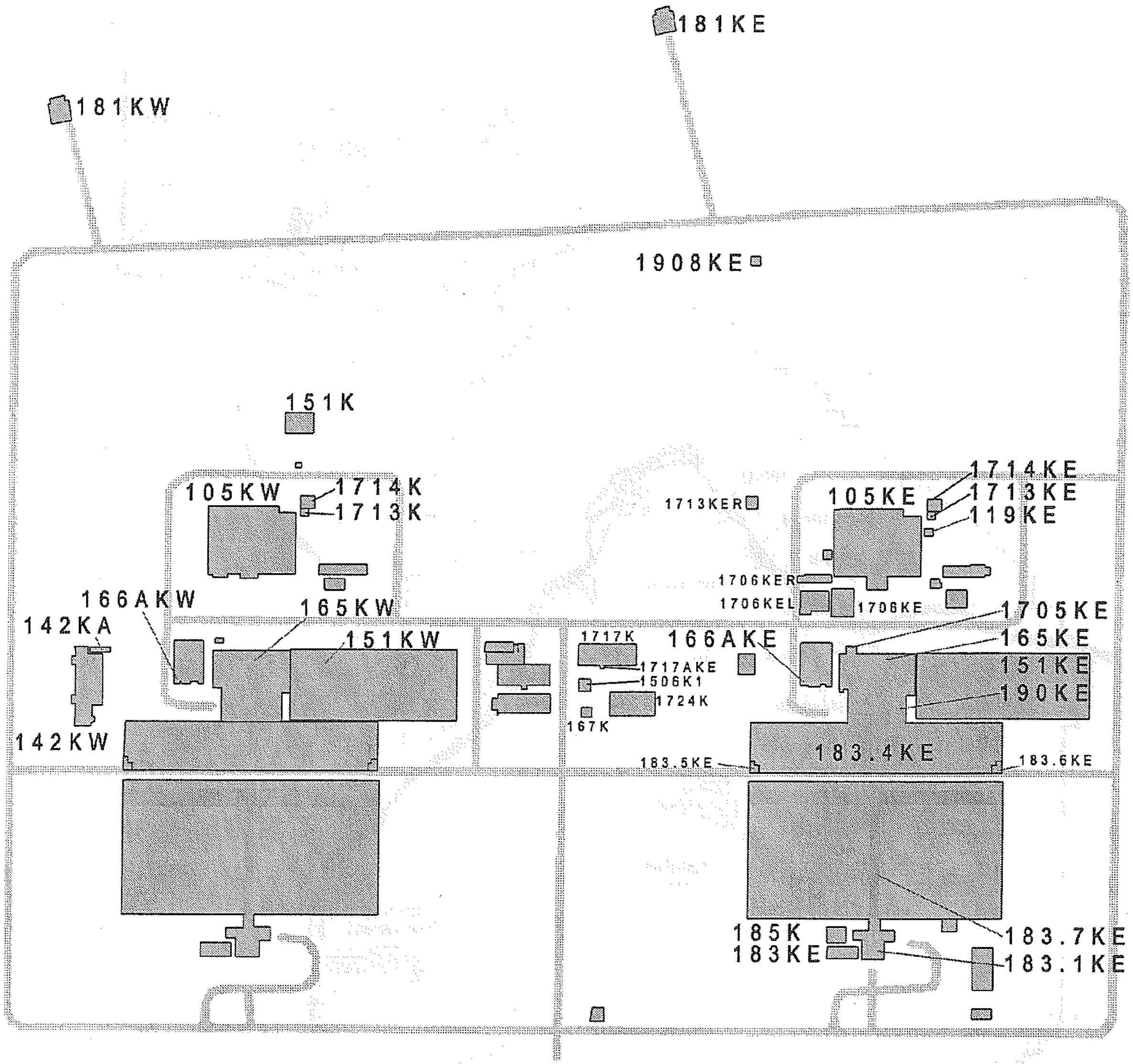


Figure 1-2. Map of the 100-K Area.



2.0 SITE CHARACTERIZATION

2.1 BACKGROUND AND SITE DESCRIPTION

Background information on the 100-K Area is provided in the following subsections, including operational history, land use and access, ecological setting, and cultural resources.

2.1.1 General Description of the Hanford Site 100-K Area

The 100-K Area is located in the north-central portion of the Hanford Site, along the southern shoreline of the Columbia River. Construction of the KE and KW Reactor areas began in 1952 as part of the "Project X" expansion program. Project X was, in part, a response to the Korean conflict and tensions with the Chinese and Russians during the Cold War. The reactors and many of the associated supporting facilities were designed to withstand an enemy attack. This was accomplished in a variety of techniques that included the following:

- Construction of facilities below grade and/or as low as possible
- Physical separation of facilities
- Alternate sources of power
- Critical piping and wiring placed below grade
- Water and fuel storage placed below grade
- Facilities designed with frangible[4] walls and roofs.

Completion of the reactors was accomplished in 27 months from beginning to end. Startup of the reactors began in 1955. At that time, the reactor design was the largest constructed at the Hanford Site, beginning at 1,850 megawatts and gradually reaching 4,000 megawatts. Operations were discontinued in 1970 for the KW Reactor and in 1971 for the KE Reactor. Most of the facilities were deactivated with the shutdown of the reactors, with the exception of the fuel storage basins, the alum tanks adjacent to the 183.1-KE Building, research and development conducted in the 1706-KE Building, one pump-house, one water treatment facility, and septic tanks and drain fields used for sanitary waste.

Since the 1980s, a portion of the 100-K Area infrastructure has been kept operational to support the storage and remediation of spent fuel in the K Basins. While the vast majority of the fuel has been removed, some of these, buildings and systems remain active to support the final spent fuel removal, sludge removal and deactivation of the basins. As these activities are completed, the remaining facilities and systems will be released for disposition in accordance with the action memorandum associated with this EE/CA.

[4] "Frangible" refers to structures that are easily broken or breakable under external stress or forces.

2.1.2 Land Use and Access

Public access to the Hanford Site, including the 100-K Area, is currently restricted. Current land use in the 100-K Area consists of environmental cleanup activities and the removal of materials from the storage basins. Adjacent to and north of the 100-K Area, the Columbia River is accessible to the public for recreational use (e.g., boating and sport fishing). The river segment located north of the 100-K Area (referred to as the Hanford Reach) received National Monument status in 2000 (65 FR 37253).

In prehistoric and early historic times, the area along the banks of the Columbia River, including the 100-K Area, was a focal point for camping and village sites for Mid-Columbia Plateau Native American tribes. More recently, before government acquisition of the land in January 1943, the area was used for irrigated and dry-land farming and livestock grazing.

The CERCLA cleanup standards selected for response actions throughout the 100 Area in the past have been based on a rural-residential exposure scenario. The land use recommended herein must be consistent with the previous remedial action to be taken in the area in accordance with NCP requirements (40 CFR 300.415[b][5][ii]). The river islands and quarter-mile buffer zone constitute the Hanford Reach National Monument created by Presidential Proclamation 7319 (65 FR 37253), which states that the 100 Areas will not be developed for residential or commercial use in order to protect the area's cultural and natural resources. The majority of the 100-K Area facilities are not within the quarter-mile buffer zone.

The high-intensity and low-intensity recreation designations are limited to specific sites and areas, none of which are in the 100-K Area. The remainder of land within the Columbia River corridor outside the quarter-mile buffer zone is designated for "conservation (mining)." This designation will allow DOE to protect sensitive cultural and biological resource areas while allowing access to geologic resources in support of governmental missions or to further the biological function of wetlands (e.g., conversion of a gravel pit to a wetland by excavating to groundwater). Restrictions on certain uses may continue to be necessary to prevent the mobilization of contaminants, the most likely example of such restrictions involving activities that discharge water to the soil or excavate below a specified depth.

2.1.3 Flora and Fauna

The ecological setting within the 100-K Area perimeter fence is highly disturbed, with large graveled areas adjacent to the facilities. The area surrounding the 100-K Area is characterized as an arid to semi-arid shrub-steppe vegetation zone. The plant community to the west is a sagebrush/Sandberg's bluegrass association. The plant community to the east (that surrounds the pump-and-treat facilities) is dominated by cheatgrass, Sandberg's bluegrass, rabbitbrush, Russian thistle, and tumble-mustard. The animal community in the surrounding area includes several species of birds, mammals, reptiles, and insect groups that are adapted to the semi-arid environment. The ecological setting of the Hanford Site, including the 100-K Area, is described in the *Hanford Site National Environmental Policy Act (NEPA) Characterization* (PNNL 2005).

Within the 100-K Area, most of the complex has been characterized as highly disturbed by industrial/waste management operations to the extent that plant communities are sparse, and complete ecological communities represented by common food webs are limited. No plants or animals on federal or state lists of endangered or threatened species are known to occur within the 100-K Area perimeter fence. There are no perennial or ephemeral streams or regulated wetlands within the complex. Outside the northwest corner of the 100-K Area, there is a grove of trees that are a communal night roost site for bald eagles during the winter months. Bald eagles are federal and state threatened species. This roost is within 100 m of the fence, and appropriate mitigation actions must be conducted when activities could impact the roost. The *Bald Eagle Site Management Plan for the Hanford Site, South-Central Washington* (DOE-RL 1994a) describes appropriate mitigation actions and requirements for consultation with the U.S. Fish and Wildlife Service if there is a potential to affect roosting eagles.

Steelhead trout and spring-run Chinook salmon are listed as endangered species in the Hanford Reach of the Columbia River. Activities that occur at or near the shoreline that could have the potential to affect these fish or their habitat must provide mitigation measures to reduce or eliminate the potential to affect. The *U.S. Department of Energy Hanford Site Threatened and Endangered Species Management Plan – Salmon and Steelhead* (DOE-RL 2000) describes mitigation actions and requirements for consultation with NOAA Fisheries (National Marine Fisheries Service) when there is a potential to impact these species.

Before initiating a project on the Hanford Site, ecological reviews are conducted to determine if sensitive plant or animal species are present and prescribe mitigation actions if they are. If federally listed species are identified and there is a potential effect those species, appropriate consultations will be initiated in accordance with the *Endangered Species Act*. Because the 100-K Area is highly disturbed within the perimeter fence, the most likely ecological concern is from nesting birds protected by the *Migratory Bird Treaty Act of 1918* (16 U.S.C. 703 et seq.). At locations with nesting migratory birds, the nests cannot be disturbed until the young have fledged. Annual baseline ecological reviews include surveys for nesting birds and a reconnaissance to determine if any sensitive plants are growing in the 100-KArea. Following the annual review, the project will be notified of any active nests or sensitive issues, and appropriate actions will be taken.

2.1.4 Cultural Resources

The 100-K Area bounds a culturally sensitive area, having been occupied prehistorically and historically by Native Americans. Building construction and general industrial activities have disturbed much of the 100-K Area, including the geographical area addressed in this EE/CA. However, Native American village sites and at least one cemetery still exist within areas that have not been disturbed adjacent to the area addressed in this EE/CA.

Prior to initiating a project on the Hanford Site, a cultural resource review is required to ensure that impacts to cultural resources will not occur. A cultural resources review will be performed in compliance with the requirements of the *National Historic Preservation Act of 1966* (NHPA) (16 U. S.C. 470) and the *Programmatic Agreement Among the U.S. Department of Energy*

Richland Operations Office, the Advisory Council on Historic Preservation, and the Washington State Historic Preservation Office for the Maintenance, Deactivation, Alteration, and Demolition of the Built Environment on the Hanford Site, Washington (programmatic agreement) (DOE-RL 1996) to address the 100-K Area facilities.

Thirty-eight Cold War era buildings and structures have been inventoried in the 100-K Area. Fourteen of these (105-KW, 107-KW, 116-KW, 117-KW, 119-KW, 181-KW, 183-KW, 190-KW, 1701-K, 1706-KE, 1706-KER, 1717-K, 1720-K, and 1908-KE) were determined to be contributing properties within the Hanford Site Manhattan Project and Cold War Era Historic District and, therefore, are eligible for listing in the National Register of Historic Places. Six of these buildings are included in the scope of this EE/CA and are identified in Table 2-1.

Table 2-1. Buildings at the 100-K Area in this Engineering Evaluation/Cost Analysis Scope with Historical Significance.

Building	Description
105-KW	Reactor Building
181-KW	River Pump House
1706-KE	Water Studies Semi-Works Building
1706-KER	Water Studies Recirculation Building
1717-K	Maintenance/Transportation Shop
1908-KE	Effluent Water Monitoring Station

As required by Stipulation II (A) of the programmatic agreement (DOE-RL 1996), the operational history and/or significant engineering achievements of these eligible properties was documented on either Expanded Historic Property Inventory Forms or standard Historic Property Inventory Forms. The contribution these structures made to the Cold War is described in *History of the Plutonium Production Facilities at the Hanford Site Historic District, 1943-1990,* (DOE-RL 2002), which is consistent with the programmatic agreement, Stipulation VI.

Physical effects to these eligible properties, up to and including demolition, have been mitigated. In compliance with the programmatic agreement (Stipulation V[C]), the contents of these eligible properties were also evaluated to identify artifacts that may have interpretive or educational value as exhibits within local, state, or national museums. Nine artifacts were located and marked for retention within 105-KW. Appropriate documentation has been completed for the contributing buildings in the 100-K Area under the programmatic agreement (DOE-RL 1996). Interior assessment of the 100-K buildings has been conducted to identify and tag artifacts that may have interpretive or educational value. Tagged items would be removed from buildings and transferred to safe storage or photographed before any demolition activities occur.

2.2 FACILITY AND WASTE SITE DESCRIPTIONS

The facilities addressed in this EE/CA include the 105-KE and 105-KW Reactors and a combination of support facilities, storage buildings, shops, and offices located in the 100-K Area (Figure 1-2). Appendix A provides descriptions of each facility. In addition, any 100-KR-1 or 100-KR-2 OU waste sites that are present beneath and/or adjacent to facilities included in this EE/CA are identified in Table 2-2.

Table 2-2. Buildings and Potentially Impacted 100-KR-1/100-KR-2 Operable Unit Waste Sites Included in the Scope of the EE/CA. (3 Pages)

Building Number	Building Name	Potentially Impacted WIDS Sites
105-KE	Reactor Building	118-KE-1 (105-KE Reactor Building), 130-KE-1 (105-KE Emergency Diesel Oil Storage Tank), 100-K-3 (Fish Pond Heat Exchanger Pit), UPR-100-K-1, 100-K-69 (Sump), 100-K-42 (Fuel Storage Basin), 100-K-56 (100-KE Reactor Cooling Water Effluent Pipeline), 100-K-70 (105-KE Radioactive Waste Storage Tank), 100-K-68 (105-KE Pump Gallery & Catch Tank "D Sump"), 100-K-47 (1904-K Process Sewer), 100-K-53 (100-KE Glycol Heat Recovery Underground Pipelines), 100-K-71 (105-KE Collection Box), 116-KE-3 (105-KE Fuel Storage Basin Injection Well), 100-K-62 (117-KE Filter Building), 132-KE-1 (116-KE Reactor Exhaust Stack), 100-K-6 (Vacuum Pit, Cyclone Separator), 100-K-46 (119-KE French Drain)
105-KW	Reactor Building	118-KW-1 (105-KW Reactor Building), 130-KW-1 (105-KW Emergency Diesel Fuel Tank), 132-KW-1 (116-KW Reactor Exhaust Stack), 100-K-43 (105-KW Fuel Storage Basin), 100-K-75 (105-KW Sump C), 100-K-74 (105-KW Waste Storage Tank), 100-K-72 (105-KW Pump Gallery and Catch Tank "D Sump"), 116-KW-2 (105-KW Storage Basin French Drain), 100-K-73 (105-KW Collection Box), 100-K-59 (100-KW Service Water Pipelines – rejected site), 100-K-47 (1904-K Process Sewer), 100-K-55 (100-KW Reactor Cooling Water Effluent Underground Pipeline), 100-K-54 (100-KW Glycol Heat Recovery Underground Pipeline), 100-K-61 (117-KW Filter Building), 100-K-1 (119-KW French drain exhaust air)
119-KE	Exhaust Air Sample Building	100-K-46 (119-KE French Drain), 130-KE-1 (105-KE Emergency Diesel Oil Storage Tank), 132-KE-1 (116-KE Reactor Exhaust Stack)
165-KE	Power Control Building	100-K-67 (165-KE Power Control Building), 120-KE-8 (165-KE Brine Mixing Tank/Pit), 130-KE-2 (166-KE Oil Storage Tank), 100-K-48 (100-KE Oil Contamination Area), 100-K-5 (1705-KE French Drain),

Table 2-2. Buildings and Potentially Impacted 100-KR-1/100-KR-2 Operable Unit Waste Sites Included in the Scope of the EE/CA. (3 Pages)

Building Number	Building Name	Potentially Impacted WIDS Sites
165-KW	Power Control Building	100-K-66 (165-KW – Power Control Building), 120-KW-6 (165-KW Brine Mixing Tank/Pit), 130-KW-2 (166-KW Oil Storage Tank)
166A-KE	Oil Storage Facility Valvehouse	130-KE-2 (166-KE Oil Storage Tank)
166A-KW	Oil Storage Facility Valvehouse	130-KW-2 (166-KW Oil Storage Tank)
1705-KE	Effluent Water Treatment Pilot Plant	120-KE-8 (165-KE Brine Pit), 100-K-5 (1705-KE Building French Drain), 100-K-58 (Clean Service Water Pipelines – Rejected), 100-K-47 (1904-KE Process Sewer)
1706-KE	Water Studies Semi-Works Building	100-K-3 & 100-K-4 (1706-KE Wet Fish Studies Ponds and Valvepit), 100-K-36 (1706-KE Chemical Storage Facility Dry Well), 100-K-37 (1706-KE Sulfuric Acid Tank), 100-K-38 (1706-KE Caustic Soda Tank), 100-K-52 (1706-KE Wet Fish Studies Lab), 116-KE-2 (1706-KER Waste Crib), 116-KE-6A (1706-KE Condensate Collection Tank), 116-KE-6B (1706-KE Evaporation Tank), 116-KE-6C (1706-KE Waste Accumulation Tank), 116-KE-6D (1706-KE Ion Exchange Column)
1706-KER	Waste Studies Recirculation Building	116-KE-2 (1706-KE Waste Crib)
1714-KE	Oil and Paint Storage Shed	100-K-53 (Glycol Heat Recovery Pipelines)
1714-KW	Warehouse	100-K-54 (Glycol Heat Recovery Pipelines)
1717-K	Maintenance/Transportation Shop	130-K-1 (1717-K Gasoline Tank), 130-K-2 (1717-K Waste Oil Storage Tank)
181-KE	River Pump House	100-K-64 (100-KE Flood Plain Contamination Area)
181-KW	River Pump House	100-K-63 (100-KW Flood Plain Contamination Area)
183.1-KE	Headhouse	100-K-58 (Clean Service Water Pipes – Rejected), 100-K-35 (183-KE Acid Neutralization Pit), 100-K-27 (183-KE Caustic Soda Tank Site), 120-KE-25 (183-KE Caustic Neutralization Pit), 120-KE-1 (183-KE Filter Waste Facility Dry Well), 120-KE-2 (183-KE Filter Waste Facility French Drain), 120-KE-3 (183-KE Filter Water Facility Trench), 120-KE-4 (183-KE1 Sulfuric Acid Storage Tank), 120-KE-5 (183-KE2 Sulfuric Acid Storage Tank), 120-KE-6 (183-KE Sodium Dichromate Tank), 120-KE-9 (183-KE Brine Pit), 126-KE-2 (183-KE Liquid Alum Storage Tank #2), 126-KE-3 (183-KE Liquid Alum Storage Tank #1)

Table 2-2. Buildings and Potentially Impacted 100-KR-1/100-KR-2 Operable Unit Waste Sites Included in the Scope of the EE/CA. (3 Pages)

Building Number	Building Name	Potentially Impacted WIDS Sites
183-KE	Chlorine Vault	Same as 183.1-KE above
1908-KE	Effluent Water Monitoring Station	100-K-47 & 100-K-60 (Effluent Pipelines)
190-KE	Main Pump House	100-K-67 (165-KE Power Control Building)

KE = K East
KW = K West
UPR = Unplanned Release
WIDS = Waste Information Data System

2.2.1 Source, Nature, and Extent of Contamination

The source of contamination at each facility depends on the specific operations conducted at the facility. In general, contamination at the facilities addressed in this EE/CA resulted from activities associated with the operation of two single-pass, water-cooled reactors that were used to produce weapons-grade plutonium. The 100-K Area facilities provided treated water, backup power and steam, material storage and distribution, and maintenance support during construction, operation, and deactivation of the reactors. Radiological and hazardous material contamination may be associated with these facilities.

To the extent practicable, hazardous substances (including bulk chemicals that are no longer in use) have been, or will be, removed from the facilities during routine operations and S&M. However, at many of the facilities, residual contamination remains or will remain on facility surfaces (including the roof), in piping and ductwork, and in structural materials. In general, the primary contaminants of concern include the following radionuclides:

- Americium-241
- Cesium-137
- Cobalt-60
- Strontium-90
- Tritium
- Plutonium.

At most of the facilities, the activities of individual isotopes are not currently known but will be determined, as needed, through data quality objective directed sampling and analysis tasks before disposal.

The facilities are also expected to contain one or more of the nonradioactive hazardous substances known to be present in most Hanford Site facilities as either contaminants resulting from facility operations or as components of structural materials. These may include the following:

- Friable and nonfriable forms of asbestos
- Lead
- Chromium
- Polychlorinated biphenyls (PCBs)
- Mercury (in switches, gauges, and thermometers)
- Refrigerants (Freon)
- Petroleum products
- Water treatment chemicals
- Lubricants
- Corrosives
- HEPA filter media
- Sodium-vapor and mercury-vapor lighting.

The concentrations of contaminants will be determined, as needed, through data quality objective directed sampling and analysis tasks before disposal.

2.3 RISK EVALUATION AND SITE CONDITIONS THAT JUSTIFY A REMOVAL ACTION

The reactors and ancillary facilities addressed in this EE/CA are contaminated or potentially contaminated with radioactive and/or nonradioactive hazardous substances. The risks associated with the radioactive and nonradioactive contaminants have not been quantified. The following discussion provides a qualitative discussion of the risks.

The major contaminants of concern at the facilities addressed in this EE/CA are radionuclides, which are known carcinogens. Many of the facilities may contain low levels of radiological contamination as surface contamination or as a part of the structural material. Hazardous substances, including asbestos insulation, heavy metals (such as mercury in switches and lead shielding), and PCBs in building materials, are also present in the facilities.

A security fence currently surrounds the majority of the area to limit unauthorized entrance of site personnel. In addition, the area requires a DOE badge for entry, and the individual facilities are locked and require special entry approval. As long as the DOE retains control of the 100-K Area, these institutional controls may prevent direct contact with and exposure to the hazardous materials. However, institutional controls will not prevent deterioration of the facilities and potential release of contaminants to the environment. Contaminants could be released directly to the environment through a breach in a pipe, containment wall, roof, or other physical control as the buildings age and deteriorate. Contaminants could also be released to the environment indirectly through animal intrusion into the contaminated structures and systems.

Historically, intrusion and spread of contamination by rodents, insects, birds, and other organisms has been difficult to control and prevent.

Potential release of contaminants is currently mitigated through an ongoing S&M program. However, as the facilities continue to age and deteriorate, the threat of potential release of radioactive and hazardous substances increases, and it becomes more difficult to confine these materials from the environment. The S&M activities required to confine the hazardous substances may increase the risk of potential exposure to personnel. The potential exposure to workers and wildlife, the threat of future releases, and the risks associated with contamination at the facilities addressed in the EE/CA justify a non-time-critical removal action.

3.0 REMOVAL ACTION OBJECTIVES

The primary purpose of this EE/CA is to evaluate the removal alternatives for the 105-KE and 105-KW Reactor Buildings (excluding the reactor blocks) and the remaining ancillary facilities (described in Appendix A). The removal alternative would be conducted in a manner that is protective of human health and the environment. The facilities contain, or potentially contain, radioactive and nonradioactive hazardous substances, either as contamination or as structural components. The contaminants and risks posed by these remaining facilities were described in Section 2.2.

This EE/CA was prepared to develop removal action alternatives for the remaining 100-K Area ancillary facilities noted in Appendix A. The scope of the subsequent removal action will address the facilities and in some cases, newly discovered soil contamination. Some soil remediation may be performed in conjunction with D4 work as described in Section 1.1.

Based on the potential hazards identified in Section 2.2, the following removal action objectives have been identified:

- Protect human receptors from exposure to contaminants above acceptable exposure levels within facility structures
- Control the migration of contaminants from the facilities into the environment
- Facilitate and, to the extent practicable, be consistent with anticipated remedial actions within the 100-K Area OUs
- Prevent adverse impacts to cultural resources and nesting migratory birds
- Achieve applicable or relevant and appropriate requirements (ARARs) to the fullest extent practicable
- Safely treat, as appropriate, and dispose of waste streams generated by the removal action
- Take no action that will preclude the eventual final disposition of the 105-KE and 105-KW Reactor blocks.

4.0 IDENTIFICATION OF REMOVAL ACTION ALTERNATIVES

The removal action alternatives for the 105-KE and 105-KW Reactors and the remaining ancillary facilities included in the scope of this EE/CA must be protective of human health and the environment and must not inhibit future implementation of remedial action operations for 100-KR-1/100-KR-2 OU waste sites located in the same geographical area. As presented in Section 2.0, the primary threats to be addressed in the selection of a removal action alternative are radioactive and/or nonradioactive hazardous substances contained in or around the facilities, and their contaminated surfaces, and the poor physical condition of selected facilities.

Based on the above considerations, the following three removal action alternatives were identified for the facilities:

- Alternative I: No action, except current Hanford Site institutional controls.
- Alternative II: ISS of the 105-KE and 105-KW Reactors followed by long-term S&M with site institutional controls and D4 of the ancillary facilities and portions of the 105-KE and 105-KW Reactor Facilities.

  This alternative includes immediate D4 and ISS.

- Alternative III: Long-term S&M with site institutional controls followed by D4 of the ancillary facilities and the 105-KE and 105-KW Reactor Facilities.

  This alternative includes S&M for the ancillary facilities until 2018 and until 2060 for both reactors. The S&M is followed by D4 of all facilities and reactor block removal.

4.1 ALTERNATIVE I – NO ACTION

Evaluation of a no action alternative is required to provide a baseline for comparison with other active alternatives. Under the no action alternative, neither D4 activity nor ISS activities would be performed, and current S&M activities would be discontinued. Hanford Site institutional controls (e.g., fencing and posted signs) would be maintained to help warn of hazards and to control worker and public access to the facilities. No other specific controls would be established for the facilities covered by this EE/CA. Because the facilities would not be decontaminated and no action would be taken to stop the facilities from deteriorating, there would be an increased threat and likelihood for a release of hazardous substances, potentially exposing workers, the public, or the environment. In addition, the no action alternative would impede remedial action progress for the 100-KR-1/100-KR-2 OU waste sites located in the geographical area. There is no cost associated with the no action alternative.

4.2 ALTERNATIVE II – ISS OF THE 105-KE AND 105-KW REACTORS FOLLOWED BY LONG-TERM S&M, AND D4 OF ANCILLARY FACILITIES AND PORTIONS OF THE 105-KE AND 105-KW REACTOR BUILDINGS

Alternative II would consist of D4 of portions of the two reactor buildings (up to the reactor shield walls) and all of the remaining ancillary facilities, implementing ISS for the 105-KE and 105-KW Reactors, and associated waste disposal. Also included in this alternative is the construction of an SSE over the reactor block that would prevent advanced structural deterioration and potential release of radionuclide or other hazardous substances, followed by long-term S&M of the 105-KE and 105-KW Reactor Facilities with Hanford Site institutional controls as described in Section 4.1. The goal of the ISS is to ensure that the SSE structure provides durable, long-term storage and safe access for interim inspections for the duration of the ISS period, through 2068, during which the reactor block for 105-KE and 105-KW would be prepared for transportation and transported to the 200 Area Plateau for disposal. This alterative would involve several stages and would be implemented as described in the following subsections. Until the start of work within this alternative, the facilities will remain in the present S&M mode.

4.2.1 D4 Activities

The purpose of deactivation is to identify and remove barriers (e.g., physical, chemical, and radiological) prior to demolition of each facility. An assessment would be performed consisting of radiological surveys and sampling, characterization, and preparation of all engineering and safety documents and work packages to perform the field work. Before beginning deactivation, ongoing missions/programs must be shut down, and personnel and equipment/property must be relocated. After the radiological conditions are established, biological cleanup and general housekeeping would be completed (e.g., remove loose biological feces and rubble, sweep and vacuum floors). Asbestos-containing material would be removed in accordance with existing procedures and an approved asbestos abatement work plan. Typically, space deactivation would be performed first, including removal of small miscellaneous items (e.g., PCB ballasts, batteries, lead, and mercury switches). Following the removal of small items, any remaining process and utility systems would be removed and drains would be plugged. Piping systems would be drained and residual materials would be removed from tanks, lubricant reservoirs, and refrigerant systems.

When deactivation is complete, all hazardous and radiological components would be removed or fixed in place to allow safe and cost-effective demolition of the facility. After the residual solid and liquid bulk hazards have been removed, the area, equipment, systems, and components would be decontaminated (when practical) or stabilized.

Following deactivation, the other D's (decontamination, decommissioning, and demolition) performed for this alternative would consist of radiological surveys, industrial hygiene surveys, asbestos removal, and building demolition/removal. Waste management/disposal would be performed as described in Section 4.4.2. Decontamination would be performed, to the extent feasible, to satisfy one or more of the following objectives:

- Minimize worker exposure to contaminants during demolition
- Reduce contaminated waste volumes
- Ensure that fugitive emissions do not exceed applicable air standards during demolition
- Reduce costs associated with worker protection and waste disposal.

Loose, accessible radiological contamination would be removed from components, equipment, structures, etc., if necessary to meet the waste acceptance criteria for the selected disposal facility. When practical, decontamination activities would be performed within proximity of the remediation work area using standard industry and best management practices, including minimizing the amount of water or cleaning fluids used.

When physical removal is not feasible or cost-effective, contamination would be stabilized or "fixed" so that contaminants would remain attached to the materials and would be less likely to be disturbed during subsequent demolition activities. Common methods of fixing contamination include painting, applying asphalt, or spreading plastic sheeting.

Decontamination of the facilities may be required to prepare them for demolition. Decontamination of reactor support areas would be required to prepare the reactor building for ISS. Decontamination could be accomplished through a variety of methods such as scabbling or scaling or "fixing" the contamination. Specific to preparation for the ISS, loose contamination would be removed or fixed to the greatest extent feasible in accessible areas within the shield walls.

Demolition would apply to the ancillary facilities and portions of the 105-KE and 105-KW Reactor Facilities and may be preceded by dismantling building components, such as severing and removing ductwork or selectively removing a wall or structure. Demolition generally means large-scale destruction using heavy equipment (e.g., excavator with a hoe-ram, shears, and concrete pulverizer), explosives, or other industrial methods. Demolition of the facilities would consist of removing all above-grade structures. In some cases, it would also involve removing portions of the below-grade structures and underlying soil, as described in Section 4.2.3. The first phase of demolition at the 105-KE and 105-KW Reactor Facilities would involve removing the reactor support areas and any associated foundations outside the reactor shield walls, whether at grade or subsurface. Below-grade structures would be removed to a minimum of 0.9 m (3 ft) below surrounding grade. The second phase of reactor demolition would involve removing selected equipment, materials, and structural components from inside the reactor shield walls to prepare for the SSE as described in Section 4.2.2.

Demolition methods would be selected based on the structural elements to be demolished, remaining radionuclide contamination, location, and integrity of the reactor shield walls. There are no unique features of the facilities that would suggest a need for use of innovative demolition methods. Consequently, no alternatives to the use of standard demolition techniques are identified. To the extent possible, steel would be segregated for salvage, unless it is contaminated or removal is not economically feasible. Piping, duct, conduit, and small equipment (e.g., pumps, motors, and vacuum units) may be dismantled and recycled, or loaded into waste containers for transport and disposal at the Environmental Restoration Disposal Facility (ERDF) or another approved waste facility in accordance with Section 4.4.2.

Subsurface structures and remediation of soils already identified as waste sites and covered under existing 100-KR-1 and 100-KR-2 OU RODs are excluded from this evaluation. However, where the existing waste site is to be fully removed in the building footprint or layback, the remediation of these waste sites may be completed in conjunction with this removal action and verified to meet the cleanup requirements of the applicable ROD. Unanticipated contaminated soil found during and/or remaining after structure removal may be identified as a new waste site. Relatively small contamination areas may be remediated/removed along with removal of structures as provided in the action memorandum. In the event that large volumes of contaminated soil are encountered, other soil contamination sites are adversely affected by D4 activities, utilities of active facilities are impacted, or removal of contaminated soil inhibits D4 activities, the action memorandum may provide that removal of contaminated soils or structure (i.e., slab, below-grade structure) may be deferred to future remedial action with approval of the EPA. The sites will be stabilized in a manner that will not hinder future remediation and will be cleaned up in accordance with the Remaining Sites ROD (EPA 1999). The facility slab or foundation may be left in place at grade to stabilize the site to accomplish one or more of the following objectives:

- Limit infiltration into an underlying waste site during the period between D4 and remedial action
- Minimize/reduce potential exposure to contaminants from an underlying waste site
- Avoid double handling and potential cross-contamination of clean backfill material during remedial action.

Water would be used to control dust during demolition activities. Recognizing a need to limit infiltration into underlying 100-KR-1/100-KR-2 OU waste sites, water would be applied to achieve adequate dust control while minimizing the overall amount of water used.

To the extent possible based on the nature of contaminants and the ability to prevent spread of contamination, heavy equipment would be moved from one facility to the next, with little or no decontamination of the equipment between facilities. When decontamination is required for equipment release or transfer to the next building, standard industry and best management practices would be used. Spent decontamination water and associated contamination may be discharged to the ground in accordance with the requirements of the project removal action work plan (RAWP) provided to EPA for review and approval. In certain circumstances (e.g., large volumes or at locations where there is known subsurface soil contamination) the water would be contained for treatment and disposal, or reused for dust suppression as appropriate.

4.2.2 Construction of the Safe Storage Enclosure

The existing reactor shield walls would be used as the primary enclosure for safe storage. Upon removal of the applicable components from inside the SSE and D4 of the reactor support areas surrounding the shield wall, a roof would be constructed (as required) to enclose the top of the reactor block and adjacent rooms. The roof would consist of structural steel and metal roof decking. The shield walls have supported the roof in earlier SSE structures, and the KE and KW designs are expected to be similar. Openings between the new roof and top of the shield walls would be closed with wall panel siding similar to that of the new roof. Openings and penetrations within the shield walls would be closed i.e., large and small openings or penetrations would be sealed by concrete pourbacks or steel plates, as appropriate. Figures 4-1 through 4-5 provide the conceptual layout of the 100-K Area D4 Ancillary Facilities and the SSE for the 105-KE and 105-KW Reactor Facilities.

A single-door entry into each SSE would be provided to limit and control access and would be welded shut. Necessary ventilation ducting would be installed inside the SSE that would be connected to an external portable exhaust unit prior to entry for maintenance activities. A remote monitoring system would be installed inside the reactor enclosure so that key parameters could be monitored between S&M entries. The final configuration of the building would feature the existing shield walls as the exterior of the building, a single-entry door that would be used for inspections, and a metal roof with similar siding. The equipment associated with the monitoring and electrical power and lighting would be installed in a utility room located outside of the SSE so that entry into the SSE would not be necessary to service this equipment.

4.2.3 Soil Contamination and Below-Grade Structure Decisions

This EE/CA was prepared to develop removal action alternatives for the remaining 100-K Area ancillary facilities noted in Appendix A. The scope of the subsequent removal action will address the facilities and, in some cases, newly discovered soil contamination.

Contamination may exist in the subsurface areas of the facilities covered in this EE/CA and/or in the underlying or adjacent soils. The actions needed to authorize, approve, or perform soil removal in conjunction with these D4 actions and the cleanup verification for any soil removal shall be as described in Section 1.1 and Section 4.2.1.

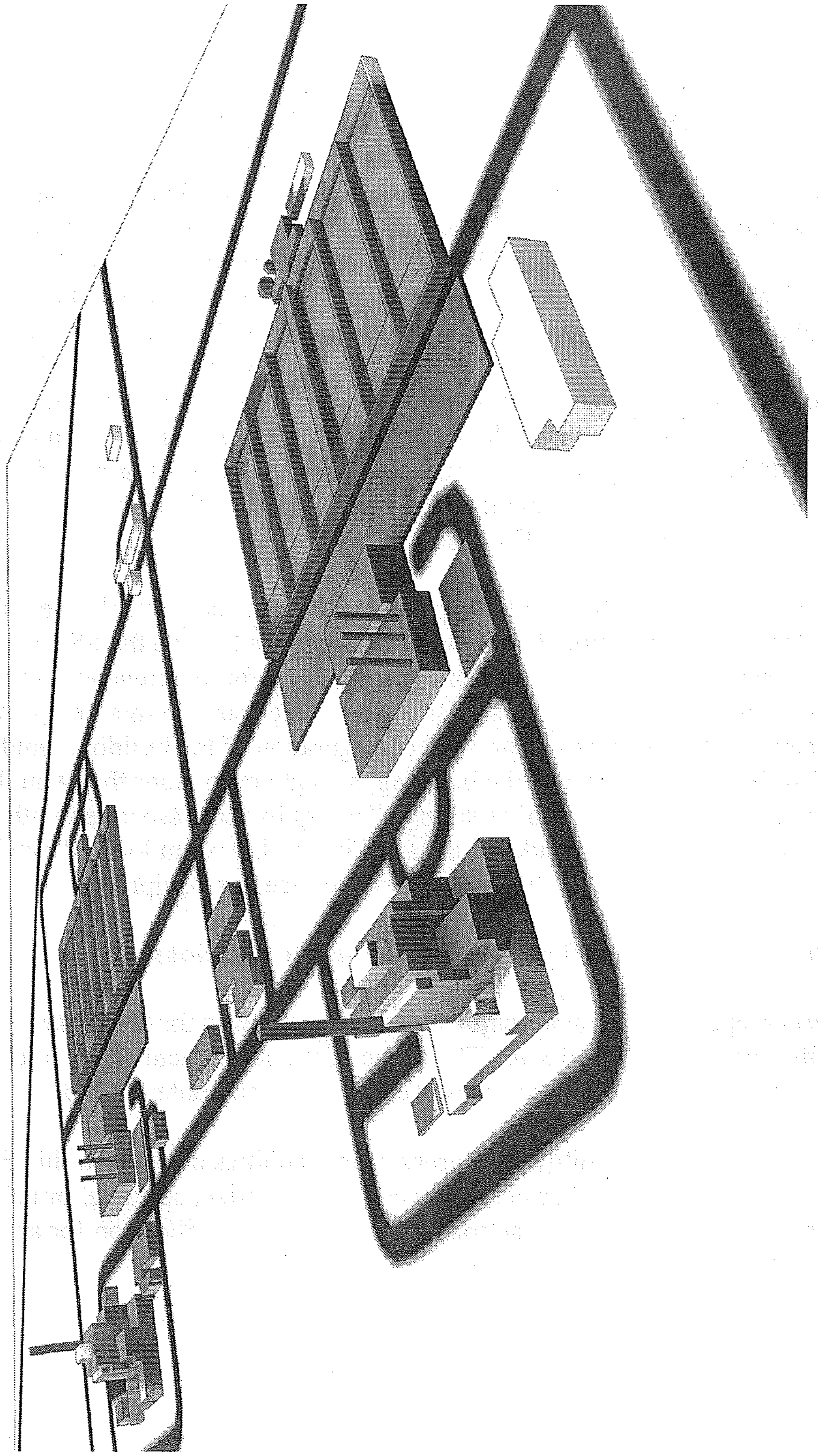


Figure 4-1. Overview of the 100-K Area.